*** ABSTRACT ONLY ***

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Suppressant Concentration Requirements for Continuously-Energized Equipment Fires

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Abstract

The National Fire Protection Association (NFPA) standard on clean agent fire extinguishing systems, NFPA 2001, was developed in response to international restrictions on the production and use of certain halon fire extinguishing agents. The standard addresses minimum requirements for total flooding clean agent fire extinguishing systems. Agent concentration necessary to suppress the fire is estimated from the result of cup burner tests assuming total gasification of agent and uniform distribution throughout the enclosure. NFPA 2001 is applied to Class A, B, and C types of fire. A basic assumption of NFPA 2001 is that agent concentration requirements for Class C type fires are comparable to Class A and B type fires.

Early work performed at 3M Company and at NIST showed that the presence of electrically heated surfaces may require greater extinguishing concentration levels than called for in NFPA 2001. In an effort to quantify the effectiveness of various agents to suppress ignition or re-ignition in the presence of heated surfaces, NIST and 3M Company entered into a CRADA agreement to investigate extinguishing agent concentration necessary for the prevention of ignition or re-ignition under several conditions of high temperature or heat flux.

NIST developed two experimental setups to evaluate agent concentration in elevated thermal fields. NIST used an apparatus intended to determine the auto-ignition temperature of premixed hydrocarbon fuels. This apparatus was used to measure the change in ignition temperature of a stoichiometric mixture of ethene-air with and without the addition of various concentrations of agent. NIST also developed a radiant exposure apparatus to quantify agent concentration in a cup burner like apparatus. This latter apparatus exposed a 25.4 mm diameter burning PMMA rod to various external irradiances and measured the agent concentration necessary to extinguish the diffusion flame. Six agents were selected for evaluation -- N_2, INERGEN (54% N_2, 40% Ar, 8% CO_2), CHF_3, C_3HF_7, C_3F_8, and C_4F_{10}.